WHAT IS CLAIMED IS:

1. An article of manufacture comprising a macroscopic mounting element capable of being manipulated or observed in a macroscale environment and a nanoscale nanotube assembly attached to said mounting element, whereby said article permits macroscale information to be provided to or obtained from a nanoscale environment.

2. The article of claim 1 wherein said mounting element is adapted to support and move said nanotube assembly.

3. The article of claim wherein said mounting element is adapted to provide an electrical connection to said nanotube assembly.

4. The article of claim 1 additionally comprising detection means operatively associated with said mounting element for detecting information obtained by said nanotube assembly in said nanoscale environment.

5. The article of claim 4 wherein said detection means is selected from the group consisting of electronic, electromechanical and optical means.

6. The article of claim 5 wherein said electromechanical detection means is a piezoelectric deflection system.

7. The article of claim 1 wherein said mounting element is a proximity probe cantilever.

8. The article of claim 1 wherein said mounting element is a proximity probe tip.

9. The method of claim 7 or 8 wherein said proximity probe is adapted for use in a microscopy system selected from the group consisting of STM, AFM and MFM.

10. The article of claim 1 wherein said nanoscale nanotube assembly comprises a single nanotube.

11. The article of claim 10 wherein said single nanotube is a carbon nanotube.

12. The article of claim 11 wherein said carbon nanotube is selected from single-wall carbon nanotubes and multi-wall carbon nanotubes.

13. The article of claim 11 wherein said carbon nanotube is a single-wall carbon nanotube.

14. The article of claim 11 wherein said single-wall carbon nanotube has insulating properties.

15. The article of claim 11 wherein said single-wall carbon nanotube has metallic properties.

16. The article of claim 15 wherein said single-wall carbon nanotube has arm chair (n,n) configuration.

17. The article of claim 15 wherein said single-wall carbon nanotube has a (10,10) configuration.

18. The article of claim 11 wherein said carbon nanotube is doped with non-carbon atoms in the fullerene lattice.

19. The article of claim 11 wherein said carbon nanotube contains an endohedrally located species.

20. The article of claim 19 wherein said endohedrally located species is selected from metals, ions, small molecules and fullerenes.

21. The article of claim 20 wherein said species is a paramagnetic material.

22. The article of claim 20 wherein said species is a ferromagnetic material.

23. The article of claim 11 wherein said carbon nanotube is derivitized with a chemical moiety.

24. The article of claim 23 wherein said chemical moiety is bound to said carbon nanotube at a position on the side of said nanotube.

25. The article of claim 23 wherein said chemical moiety is bound to the end cap of said nanotube.

26. The article of claim 1 wherein said nanotube assembly comprises a plurality of generally parallel nanotubes.

27. The article of claim 26 wherein said nanotubes are carbon nanotubes.

28. The article of claim 26 or 27 wherein said plurality of nanotubes is a bundle having from about 2 to about 10^3 individual nanotubes.

29. The article of claim 26 or 27 wherein said plurality of nanotubes is a rope having from about 10^3 to 10^6 individual nanotubes.

30. The article of claim 26 or 27, wherein said nanotube assembly comprises a body section and a tip section comprising from about 1 to about 10 individual nanotubes projecting beyond said body section.

31. The article of claim 1 wherein said nanotube assembly has a length of from about 20 to 100 times its diameter.

32. The article of claim 1 wherein said nanotube assembly is attached to said mounting element at one end and the other end of said nanotube assembly freely projects from said mounting element.

33. The article of claim 1 which is a probe for providing information from a nanoscale environment.

34. The article of claim 33 which is a probe adapted for use in a proximity probe microscopy system.

35. The probe of claim 34 wherein said proximity probe microscopy system is STM.

36. The probe of claim 34 wherein said proximity probe microscopy system is AFM.

37. The probe of claim 34 wherein said proximity probe microscopy system is MFM.

38. The article of claim 34 wherein said probe is adapted to image a surface at nanoscale resolution.

39. The article of claim 34 wherein said probe is adapted to measure properties of nanoscale objects.

40. The article of claim 39 wherein said probe is adapted to measure the elasticity of nanoscale objects.

41. The article of claim 39 wherein said probe is adapted to measure atomic scale friction of nanoscale objects.

42. The article of claim 39 wherein said probe is adapted to measure electronic properties of nanoscale objects.

43. The article of claim 39 wherein said probe is adapted to measure magnetic properties of nanoscale objects.

44. The article of claim 39 wherein said probe is adapted to measure electrochemical properties of nanoscale objects.

45. The article of claim 39 wherein said probe is adapted to measure chemical properties of nanoscale objects.

46. The article of claim 39 wherein said probe is adapted to measure biological properties of nanoscale objects.

47. The article of claim 46 wherein said probe is adapted to analyze biomolecules and components thereof.

48. The article of claim 47 wherein said probe is adapted to sequence DNA molecules by recognizing individual base moieties.

49. The article of claim 1 which is a probe for manipulating or modifying a nanoscale object.

50. The article of claim 49 wherein said probe is adapted to move a nanoscale object.

51. The article of claim 49 wherein said probe is adapted to modify a nanoscale surface by creating a pattern on the surface of said object.

52. The article of claim 51 wherein said probe is adapted to perform nanolithography.

53. The article of claim 49 wherein said probe is adapted to chemically modify said nanoscale object.

54. The article of claim 53 wherein said probe contains a chemical moiety attached to its tip to induce said chemical modification.

55. The article of claim 53 wherein said probe is adapted to emit electrons to induce said chemical modification.

56. The article of claim 53 wherein said probe is adapted to emit electromagnetic radiation to induce said chemical modification.

57. The article of claim 54 wherein said chemical moiety is a species that reacts with species on the surface of said nanoscale object.

58. The article of claim 54 wherein said chemical moiety is a catalyst for a reaction that takes place on the surface of said nanoscale object.

59. The article of claim 1 which is a tool for the fabrication of nanoscale devices.

60. The article of claim 1 wherein at least a portion of said nanotube assembly is coated with a material selected from the group consisting of thermosetting polymers, thermoplastic polymers, UV curing polymers, silicon and metals.

61. The method of claim 60 wherein said coating also covers at least a portion of said mounting element.

62. The article of claim 1 comprising an array of nanotube assemblies attached to mounting elements.

63. The article of claim 62 wherein said nanotube assemblies are each attached to separate mounting elements.

64. The article of claim 63 wherein said nanotube assemblies are attached to a common mounting element.

65. A method for making a macroscopically manipulable nanoscale device comprising:

providing a nanotube-containing material;

preparing a nanotube assembly having at least one nanotube; and

attaching said nanotube assembly to a surface of a mounting element.

66. The method of claim 65 wherein said nanotube is a carbon nanotube.

67. The method of claim 65, further comprising coating a portion of said nanotube assembly with a metal.

68. The method of claim 65, wherein said step of preparing a nanotube assembly comprises:

contacting said nanotube-containing material with an adhesive member; and

removing said adhesive member from said nanotube-containing material, whereby a plurality of nanotubes are oriented perpendicular to said surface of said nanotube-containing material.

69. The method of claim 65, wherein said step of attaching said nanotube assembly to a surface of a mounting element comprises:
translating said mounting element toward said nanotube assembly;
contacting said mounting element and said nanotube assembly; and
translating said mounting element away from said nanotube assembly.

70. The method of claim 65, wherein nanotube assembly and said mounting element are attached by van der Waals forces.

71. The method of claim 65, wherein said nanotube assembly and said mounting element are attached by adhesive bonding.

72. The method of claim 69 wherein a portion of said mounting element is coated with an adhesive prior to contact with said nanotube assembly.

73. The method of claim 72, wherein said adhesive is an acrylic adhesive.

74. The method of claim 66, wherein said surface of said mounting device is highly
graphitized carbon.

75. The method of claim 65, further comprising
coating the nanotube assembly attached to said mounting element.

76. The method of claim 75, wherein said coating is applied by dipping.

77. The method of claim 75, wherein said coating is applied by vapor phase deposition.

78. The method of claim 75, wherein said coating is selected from the group consisting of cyanoacrylate, methacrylate, Parylene®, polyimide, silicon, silica and metals.

79. The method of claim 65 wherein said attaching step is performed under observation using an optical microscope.

80. A method for imaging an object at nanoscale resolution comprising scanning the surface of said object with a proximity probe microscopy apparatus having a probe tip that comprises a nanoscale nanotube assembly.

81. A method for manipulating or modifying nanoscale objects comprising bringing a probe tip comprising a nanoscale nanotube assembly into contract

with or proximity to said nanoscale objects and actuating an interaction between said probe tip and said nanoscale object.

82. The method of claim 81 wherein said interaction is by direct physical contact.

83. The method of claim 81 wherein said interaction is effected by indirect means selected from the group consisting of electronic, chemical, mechanical, electrochemical, electromechanical, electromagnetic, magnetic and biological.